## REMARKS/ARGUMENTS

Favorable reconsideration of this application, in light of the present amendments and following discussion, is respectfully requested.

Claims 4, 8, 11, 13-15, and 18-21 are pending. Claims 4-7, 11, and 22-27 are withdrawn. Claims 1-3, 9-10, and 12 are canceled. Claims 8, 18, 19, and 21 are amended. Support for the amendment to Claim 8 can be found in now-canceled dependent Claim 17, Figs. 8a and 8b, and in the published application in paragraphs [0152]-[0155], for example. Support for the amendments to Claims 18, 19, and 21 is self-evident. No new matter is added.

In the outstanding Office Action, Claim 11 was objected to as including an improper claim identifier. The specification was objected to as not including generic terminology for the term GALDEN. Claims 8, 12, and 16-18 were rejected under 35 U.S.C. § 103(a) as obvious over Koshiishi et al. (U.S. Patent Pub. 2003/0106647, herein "Koshiishi") in view of Howald et al. (U.S. Patent No. 6,125,025, herein "Howald"). Claims 13-15 were rejected under 35 U.S.C. § 103(a) as obvious over Koshiishi, Howald, and Kanno et al. (U.S. Patent Pub. 2003/0164226, herein "Kanno"). Claims 19-21 were rejected under 35 U.S.C. § 103(a) as obvious over Koshiishi in view of Howald and further in view of Huang (U.S. Patent Pub. 2004/0005726, herein "Huang").

Regarding the objection to Claim 11 as lacking a proper claim identifier, Claim 11 includes the claim identifier "withdrawn" in the present amendment. Accordingly, Applicants respectfully submit that the objection to Claim 11 is overcome.

Regarding the objection to the specification as lacking generic terminology for the term GALDEN fluid, the specification is amended to include generic terminology for GALDEN fluid where appropriate. Accordingly, Applicants respectfully submit that objection to the specification is overcome.

Regarding the rejection of Claims 8, 12, and 16-18 as obvious over Koshiishi in view of Howald, that rejection is respectfully traversed by the present response.

Howald relates to vacuum plasma processors including an electrostatic chuck for holding dielectric workpieces in place during processing.[1] In the processor, an electrostatic chuck (30) is fixedly mounted in a chamber (10), and the chuck (30) is particularly designed to selectively hold a workpiece (32) including a non-plastic dielectric substrate.[2] The chuck (30) has a conduit (34) through which helium gas is applied opening toward the workpiece (32) and connected to a high voltage terminal (40) of a programmed DC source (38) as shown in Fig. 1.

Moreover, this processor has a computer system (64) which includes a microprocessor (66), a random access memory (RAM) (67) and a read only memory (ROM) (68) and controls the amplitude of a time varying voltage derived by the source (38), and the like.[3]

During initial processing of the workpiece (32) by the plasma in the chamber (10), the voltage at the terminal (40) is typically several thousand volts, e.g., 5000 volts (col. 10, lines 55 to 57). It is desirable during the workpiece processing by the plasma to maintain clamping voltage $V_A$ at an approximately constant value sufficient to cause the workpiece (32) to remain stuck *in situ* against the force of cooling fluid flowing through a conduit (37). This can be achieved by reducing, as a function of time, the value of the voltage applied by the source (38) to the chuck (30) after the workpiece has been clamped.[4]

The microprocessor (66) controls the source (38) to derive a sequence of time spaced decreasing step voltages during processing of glass (substrate).[5]

Moreover, the pressure sensor in combination with the microprocessor (66) controls the pressure of the helium gas supplied to the valve (35) and line (34).[6] The microprocessor

[1] Howald, col. 1, lines 6-8.
[2] Howald, col. 9, lines 28-34.
[3] Howald, col. 13, lines 6-9.
[4] Howald, col. 15, lines 59-64.
[5] Howald, col. 16, lines 7-9.

(66) is preferably programmed to execute control by applying an error (difference) signal resulting from the comparison to a proportional, integral, differential (PID) controller. See col. 16, lines 53 to 57.

The electrostatic chuck (30) has one electrode formed as high electrical conductivity metal (preferably aluminum) plate (36).[7] A smooth planar upper face (53) of the plate (36) is provided with spaced, interconnected grooves (54) as shown in FIG. 3. The conduit (34) effectively extends through the chuck (30) by virtue of the chuck including a central bore (55) to which the conduit and grooves are connected.[8]

Koshiishi relates to an object-holding apparatus mounted in a process chamber of a plasma processing apparatus or the like to hold an object to be processed.[9] A wafer-attracting electrode (22) is connected to a DC power supply (15) through a switch (24). A focus ring-attracting electrode (23) is connected to the DC power supply (15) directly.[10] This switch (24) is switched by a switch controller (25) to control the wafer attracting state. More specifically, while a wafer W is being processed, the switch (24) is ON to apply a DC voltage to the wafer-attracting electrode (22). While the wafer W is being transferred, the switch (24) is OFF to stop application of the DC voltage to the wafer-attracting electrode (22). On the other hand, a DC voltage is applied to the focus ring-attracting electrode (23) from the DC power supply (15) directly, and thus the focus ring-attracting electrode (23) is not interlocked with the motion of the switch (24).[11]

Three features recited in amended independent Claim 8 recites include:

> (a) the controller changing the chuck voltage applied to the chuck device attracting the focus ring in accordance with each of sequences of the plasma process;

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[6] Howald, col. 16, lines 60-62.
[7] Howald, col. 10, lines 50-54.
[8] Howald, col. 11, lines 33-38.
[9] Koshiishi, paragraph [0004], lines 1-4.
[10] Koshiishi, paragraph [0056], lines 6-9.
[11] Koshiishi, paragraph [0057].

> (b) the groove formed in the electrostatic chuck and provided in the contact surface of the electrostatic chuck where the electrostatic chuck is in contact with the focus ring; and
>
> (c) the controller changing the pressure of the heat transfer gas supplied from the heat exchange means to the contact surface in accordance with each of multiple steps of the plasma process.

One benefit of the arrangement recited in amended independent Claim 8 is that the chuck voltage applied to the chuck device and the pressure of the heat transfer gas in the groove are changed in accordance with each sequence (step) of the plasma process, and hence the cooling of the focus ring can be carried out stably so that occurrence of local deterioration of etching characteristics of the object to be processed can thus be reduced.

In amended independent Claim 8, the electrostatic chuck has the groove for heat exchange to further improve the efficiency of cooling of the focus ring, and both the attracting force control by the DC voltage control for the focus ring and the pressure control of the heat transfer gas are executed in accordance with each sequence of the plasma process to carry out the cooling of the focus ring stably. Therefore, the occurrence of local deterioration of etching characteristics of the object to be processed from can be reduced.

Moreover, in general, deposition radicals which will attach to objects included in radicals generated from the process gas during the plasma process tend to attach to low temperature objects, and hence the deposition radicals tend to attach the object to be processed. As recited in amended Claim 8, the focus ring is cooled so that the deposition radicals are forcibly attached to the focus ring. As a result, the occurrence of particle pollution can be reduced.

**Feature (a)**

Koshiishi merely describes changing the voltage applied to the electrostatic chuck attracting the focus ring independently from the voltage of attracting the object to be

processed, more specifically, changing the DC voltage applied to the wafer-attracting electrode (22) and not changing the DC voltage applied to the focus ring-attracting electrode (23). Koshiishi neither discloses nor suggests changing the DC voltage applied to the focus ring-attracting electrode (23) **in accordance with each of sequences of the plasma process**.

Howald describes controlling chuck voltage for the electrostatic chuck, more specifically, reducing, as a function of time, the value of the voltage applied by the source (38) to the chuck (30) clamping the workpiece as a substrate, and controlling the source (38) to derive a sequence of time spaced decreasing step voltages during processing of glass (substrate). Thus Howald describes controlling the voltage of attracting during the plasma process or in each step of the plasma process. However, Howald does not provide a focus ring, and therefore Howald neither discloses nor suggests **changing chuck voltage of attracting a focus ring in accordance with each of sequences of the plasma process**.

Moreover, Kanno and Huang neither disclose nor suggest changing chuck voltage of attracting a focus ring in accordance with each of sequences of the plasma process. Accordingly, Applicants respectfully submit that amended independent Claim 8 and the claims depending therefrom patentably distinguish over any proper combination of Howald, Koshiishi, Kanno, and Huang for at least the reasons discussed above.

**Feature (b)**

The outstanding Office Action relies on Koshiishi for the feature of groove as recited in independent Claim 8.[12] However, Koshiishi describes a gas supply path (17) extending through a second dielectric film (14b) to connect to a plurality of **openings** (17c) formed in an upper surface of the second dielectric film (14b). Koshiishi neither discloses nor suggests **grooves disposed on the upper surface of the second dielectric film (14b), where the**

[12] Outstanding Office Action, page 4.

**focus ring makes contact with the chuck**. Rather, as shown in Fig. 1 below, the openings (17c) are not grooves, but are instead merely holes penetrating the dielectric films (14a) and (14b), and the gas supply path (17) is a completely internal pathway disposed inside the holder main body (11).

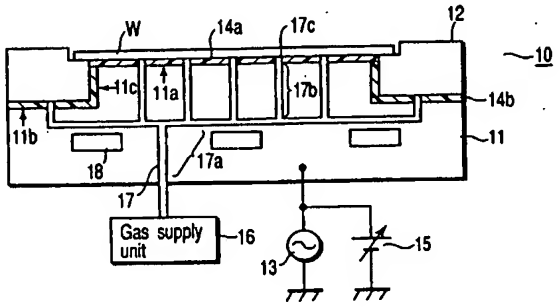


FIG. 1

Regarding the openings (17c), Koshiishi states:

> The gas supply path 17 introduces a gas from an external gas supply unit 16 to control the temperature of the wafer W. The gas supply path 17 is formed of a trunk portion 17a, and branch portions 17b branching from the trunk portion 17a and extending through the first and second dielectric films 14a and 14b to connect to a plurality of openings 17c formed in the upper surfaces of the first and second dielectric films 14a and 14b. In this arrangement, a temperature-controlled cooling gas, e.g., helium (He) gas, from the gas supply unit 16 is sprayed to the lower surface of the wafer W and the bottom surface of the focus ring through the gas supply path 17, to cool them.[13]

Thus, the plurality of openings (17c) are merely passageways through the dielectric films (14a) and (14b) and are not grooves as a person of ordinary skill in the art would understand the term "grooves."

Howald describes grooves (54) disposed on the smooth planar upper face (53) of the plate (36) in the chuck (30) holding the workpiece (32). However, Howald neither teaches nor suggests grooves disposed on a contact surface of the chuck (30) where the chuck (30) is in contact with a focus ring (as discussed above, Howald fails to teach or suggest a focus ring as recited in amended independent Claim 8).

[13] Koshiishi, paragraph [0038].

Kanno describes gas grooves (60) disposed on a contact surface where a wafer stage (52 or 70) is in contact with a wafer as shown in Figs. 6 and 7. However, Kanno does not teach or suggest grooves disposed on a contact surface where the wafer stage (52 or 70) **is in contact with a focus ring**.

Huang describes a heat transfer means controlling a temperature of a focus ring to within a range of 100°C±30°C.[14] However, Huang is silent regarding grooves and fails to remedy the deficiencies discussed above.

**Feature (c)**

Koshiishi describes an external gas supply unit (16) supplying gas into the gas supply path (17). However, Koshiishi neither discloses nor suggests the external gas supply unit (16) **changing a pressure of supplied gas in accordance with each of multiple steps of the plasma process**. That is, Koshiishi neither discloses nor suggests changing a pressure of helium gas for the focus ring independently from that of helium gas for the object to be processed.

Howald describes pressure control of helium gas using the PID controller for temperature control, more specifically, controlling the pressure of the helium gas supplied to the valve (35) and line (34). However, Howald neither discloses nor suggests changing the pressure of the helium gas in accordance with each of multiple steps of the plasma process. Moreover, Howald neither discloses nor suggests supplying the helium gas to a contact surface of the chuck (30) where the chuck (30) is in contact with a focus ring.

Kanno describes a flow rate controller (25) controlling a pressure of helium gas supplied to a space between a wafer (1) and a wafer stage (40) (Fig. 1). However, Kanno neither discloses nor suggests changing the pressure of the supplied helium gas in accordance

[14] See paragraph [0025], lines 10 to 12.

with each of steps of the plasma process. Moreover, Kanno neither discloses nor suggests supplying the helium gas to a contact surface of the wafer stage (40) where the wafer stage (40) is in contact with a focus ring.

Huang does not teach or suggest helium gas as heat transfer gas or that a pressure of the heat transfer medium is changed in accordance with steps of a plasma process.

Accordingly, no proper combination of Koshiishi, Howald, Kanno, and Huang would include all of the features recited in amended independent Claim 8. Thus, amended independent Claim 8 and Claims 13, 14, 15, 18, 19, 20 and 21 depending therefrom patentably distinguish over any proper combination of the cited references for at least the reasons discussed above.

For the foregoing reasons, it is respectfully submitted that this application is now in condition for allowance. A Notice of Allowance for Claims 4, 8, 11, 13-15, and 18-21 is earnestly solicited.

Should Examiner Dhingra deem that any further action is necessary to place this application in even better form for allowance, Examiner Dhingra is encouraged to contact Applicants' undersigned representative at the below-listed telephone number.

Respectfully submitted,

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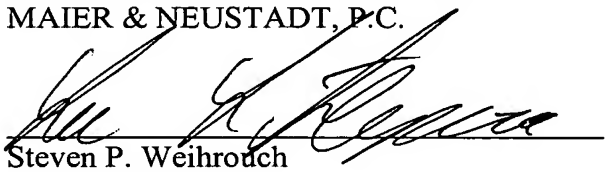

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